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THE PLANT DISEASE SURVEY

DIVISION OF MYCOLOGY AND DISEASE SURVEY

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AID OF COLLABORATORS REQUESTED IN AZALEA FLOWER SPOT SURVEY

By Freeman Weiss, Division of Fruit and Vegetable Crops and Diseases.

In 1931 a destructive flower spot appeared on cultivated azaleas in the vicinity of Charleston, S. C. Within a few days of its first appearance flowers were affected by thousands, becoming disfigured and blighted while in the prime of bloom. The disease has occurred in varying degrees of severity each year since, and therefore appears to be at least locally established. The hope that it might have been in the first instance due to an extraordinary circumstance of weather or atmospheric conditions, or to the exceptional prevalence of some flower-feeding insect has been dispelled, as the disease has now been shown to be caused by a fungus not hitherto recorded either as to description or in relation to a disease of azaleas. (See Phytopathology 25:38, 1935). As the investigation of the disease is still incomplete, a full account of the fungus and its pathological effects must for the present be deferred, but because of the importance of azaleas as ornamental plants, both in landscape plantings and as a florists' crop, it is deemed advisable to call the attention of plant pathologists, nursery inspectors and quarantine officials to the existence of this disease, and to invite their assistance in determining its distribution and possibly in shedding some light on its origin.

Symptoms: The earliest easily recognizable symptom is the appearance of small (1 to 3 mm) spots of very irregular outline, white on varieties with

colored flowers and brown on white flowers; these spots may be few in number and more or less concentrated on one area--often the two lower lobes of the corolla, or may be distributed over the entire face of the flower. Under conditions optimum for the disease, colored buds and half open flowers may show these spots, but typically they do not appear until a day or two after the flowers fully expand. The spots enlarge very rapidly in warm moist weather, reaching a diameter of 1 cm. or more in 24 hours, and under the most favorable conditions developing into blotches involving an entire petal, or by coalescence the whole flower in 1 to 2 days. When this stage is reached the flowers collapse but persist on the twigs, giving rise to a condition best described as limp blight. The surface of the spot appears viscid; the affected tissue is so thoroughly disorganized that it tears almost at a touch, and when squeezed even lightly it disintegrates. Under less favorable conditions (e.g. cool, dry weather) the development of the lesions may be arrested in the spot or blotch stage, the margin becoming more clearly defined and the center becoming translucent; the surface appears as a dirty white or pale brown. In normal azalea flowers of the Indica type, the corolla drops cleanly from the calyx and ovary, but flowers attacked by this disease typically shrivel on the twigs. When infection occurs early and the progress of the disease is rapid, the flower tissue becomes thoroughly permeated by the fungus, which forms within 5 to 6 days one to several black, somewhat cupulate sclerotia in the blighted corolla; but when infection is delayed until the flower is already aged, abscission of the corolla may occur normally without sclerotial development, or the sclerotia may form in the fallen flowers.

So far as yet observed the flower is the only part of the plant attacked, and the various spots and discolorations frequently seen in azalea foliage bear no relation to the disease. New shoot growth, normal to all appearance, occurs immediately below the blighted flowers.

Azalea flowers may exhibit other spots of fungus origin, and various types of abrasions as by insects, wind, frost, etc., but in none of these is the characteristic blotch with its irregular margin and extreme softening of tissue present. The fungi which may cause flower spotting include Botrytis and Alternaria; these and various saprophytes such as Cladosporium, Pestallotia, Aspergillus, and Penicillium can be readily identified as a rule by their characteristic mycelium or fructifications. In the new flower spot, spores are present for only a brief period and there is no fungus growth visible by a hand lens. A coarse, septate mycelium is extraordinarily abundant within the tissues during the blotch and limp blight stages, and is an aid in diagnosis when other characteristics are lacking.

Known distribution: The disease has been positively identified thus far, including the isolation of the characteristic fungus, only in a number of private and semi-public gardens bordering the Ashley and Cooper Rivers for some 20 to 30 miles above Charleston, S. C. This area includes several commercial nurseries dealing in azaleas, and the town of Summerville whose home and park plantings of azaleas are numerous, in most of which the disease has been found. Reports of its occurrence in Savannah, Ga., and

near Jacksonville, Fla., have been received from unofficial sources but have not been confirmed by the receipt of typical specimens of the disease from which the characteristic fungus could be isolated; the same is true of the reported occurrences of the disease in certain estate plantings of azaleas at Georgetown, S. C. However, no extensive survey has as yet been made beyond the environs of Charleston.

As azaleas of susceptible types have been planted extensively in estates, small gardens, and public parks from Wilmington, N. C. southward along the Atlantic Coast into northern Florida, and as the environmental conditions are generally similar throughout this region, the probability that the disease has already spread more widely than the known infested area, or is likely to do so in the near future, may be accepted.

Species and varieties affected: The azaleas of ornamental plantings in the infested area are chiefly of the group horticulturally known as Indian azaleas (Azalea simsi, A. ledifolia, A. phoenicia, and their hybrids), and to a less but increasing extent of Japanese azaleas, especially the Kurume hybrids (A. obtusa) and their hybrids with A. kaempferi. There are also a few examples of so-called Belgian azaleas (hybrids between species of Asiatic and European origin). In general all these types are susceptible to the flower spot, but the forms with large, soft-textured flowers are more severely attacked than those with small flowers of somewhat papery texture. Among the Kurume group of hybrids, and the small flowered Azalea amoena, there are forms in which the flower disfigurement is relatively slight, and does not differ appreciably from normal ageing; possibly some are resistant or immune. In most forms, however, the fungus is able to cause limited infection and to reproduce; possibly also survive, although sclerotia do not commonly form in these small flowers.

In the native species of Azalea in the Coastal Plain, A. nudiflora, A. viscosa, and A. vaseyi, infection by the flower spot fungus has not yet been confirmed, although fungus spotting of other kinds is sometimes found.

Environmental relations: The flower spot always reaches maximum development coincident with the period of maximum azalea bloom. The earliest varieties usually show no signs of the disease, but as the mid-season varieties approach full bloom, especially such varieties as Formosa, Phoenicia and Brilliant (of the Indica group), the disease appears in increasing amount. There may be recurrent waves of infection, interspersed with periods of comparative freedom from disease. The very late varieties, like the very early ones, show little or no infection but this is known to be a seasonal factor and not due to innate resistance. In general, temperatures as high as 70-80°F. are favorable to rapid spread and development of the disease, and the simultaneous occurrence of light, misty rains leads to an enormous multiplication of the early blotch stage within one or two days.

Insect relations: Field observations, especially by F. F. Smith of the Bureau of Entomology and Plant Quarantine during April, 1934, point to

the possibility that flower-frequenting insects are a factor in the dissemination of the disease, either by transporting the causal organism to healthy flowers or by causing abrasions through which it enters. Attention is being given to determine the role played by the several species of insects found on azaleas in the Charleston area. The most common species include honey bees, four species each of bumble bees and carpenter bees, and two species of thrips.

Collaborators of the Plant Disease Survey who are located near the infested areas, or in adjacent States, and who can examine azalea plantings in their localities are requested to bear in mind the following points when collecting material or sending in specimens:

1. The surest identification can be made in the field, or in material taken immediately to the laboratory and incubated under moist conditions at 60-70°F. to induce the formation of sclerotia. The fungus is difficult to isolate from material that has dried to an appreciable degree. The occurrence of sclerotia in persistent or fallen flowers is the best field index of flower spot infection.

2. In case the disease is found, correlated observations on the reaction of different varieties, relation to meteorological conditions and exposure, and the prevalence of flower-visiting insects will be welcomed. If flower specimens suspected of infection with this disease are sent via mail they should be placed in a sealed envelope and this inside a second securely sealed envelope or package of heavy paper so that there is no risk of the contents being scattered en route.

3. Flower specimens will be received for confirmation by Freeman Weiss, U. S. Horticultural Field Station, Beltsville, Md.

OBSERVATIONS ON NEMATODE DISEASES OF PLANTS

C. Steiner and Edna M. Buhrer

1. The root-knot nematode, Heterodera marioni (Cornu) Goodey, was observed on two new hosts: green foxtail grass (Chaetochloa viridis) from Kentucky and puncture weed (Tribulus terrestris) from Arizona.

2. The bulb or stem nematode, Anguillulina dipsaci (Kühn) Goodey, was seen for the first time infesting Tigridia bulbs, which were imported from Holland. Tigridia aurea and T. pavonia speciosa were affected. Colchicum bulbs, also imported from Holland, were again found infested by this nematode; in one case a shipment of 50 bulbs was 100% infested (Colchicum speciosum album), in a second case a shipment of 200 bulbs was 4.5 per cent infested (C. speciosum).

Morocco may be mentioned as a new country for this nematode. Affected Irish potatoes were intercepted by the quarantine inspectors at Baltimore.

3. The meadow nematode, Anguillulina pratensis (deMan) Goffart, was found to be a serious disease agent in Irish potato plantings in Virginia and Mississippi, in the first instance affecting some 1,300 bushels.

Among new hosts of this pest there may be mentioned Cytisus monspessulanus from North Carolina, Sesbania sp. also from North Carolina, rutabaga var. Favorite from Maryland, Ulmus parvifolia from Oklahoma (collected by Howard Lamb), and apple trees from California (collected by P. A. Ark, received through the courtesy of C. Emlen Scott).

4. The grass-seed nematode, Anguillulina agrostis (Steinbuch) Goodey, was observed in the seeds of an unidentifiable Festuca sp. which were collected in Frunze, U.S.S.R.

Squirreltail grass (Hordeum jubatum) may be mentioned as a new host of this nematode; infested material of this grass was collected by P. M. Simmonds in Tisdale, Sask., Canada, in 1922, and submitted for identification by I. L. Conners.

5. The strawberry nematode, Aphelenchoides fragariae (Ritzema-Bos) Christie, was observed for the first time in this country in the leaves of a Dahlia sp. and of Heuchera sanguinea, both grown in California and submitted by C. Emlen Scott.

6. Neotylenchus abulbosus Steiner was found on a new host, Tritonia sp. var Prometheus, which was imported from Holland and intercepted at the U.S.D.A. Inspection House in Washington, D. C.

SOME OBSERVATIONS ON TRANSFERS OF THE BULB OR STEM NEMATODE, ANGUILLULINA DIPSACI

W. D. Courtney

An attempt to work out a crop rotation program for narcissus culture, on soil infested with the bulb or stem nema, Anguillulina dipsaci, has revealed several plants as partial hosts or carriers of the disease. These experiments have been of too short duration to determine how long these plants may retain the nemic infestation.

The experiments are being conducted in an isolated field in order that soil and weather conditions would be natural. A portion of this field was securely fenced to constitute the experimental plot. A ground cage was constructed on this plot composed of a lower wall of sheet iron dug in the ground for 42 inches with the upper wall and top of ordinary fly screen. Galvanized iron containers were placed in the soil of the ground cage to a depth of 46 inches.

The soil in each container was thoroughly sterilized with steam, after which the narcissus population of A. dipsaci was introduced. A pure stand of a single crop or weed was then planted in each container. The resulting

plants were microscopically examined at intervals. The following plants were slightly stunted, exhibited some swelling at the stem bases and contained all stages of A. dipsaci:

Beans, Kentucky Wonder (Phaseolus vulgaris)
Peas, garden (Pisum sativum)
Spinach (Spinacia oleracea).

The following plants exhibited no symptoms whatever yet contained many A. dipsaci:

Oats, Swedish Select (Avena sativa)
Vetch, gray (Vicia sativa)

Under similarly controlled conditions in a different locality A. dipsaci infesting Phacelia heterophylla were transferred to red clover plants (Trifolium pratense).

It is probable, in view of these results, that the populations of A. dipsaci present in narcissus and red clover are not strictly monophagous. If such be true, plants other than the population host may carry the infestation during a period when that host is not present in the soil. Such plants must be determined before an adequate crop rotation program can be outlined.

MISCELLANEOUS NOTES ON SOME NEMATODE DISEASES OF PLANTS IN BRITISH COLUMBIA

R. J. Hastings
Laboratory of Plant Pathology, Saanichton, B. C.

Anguillulina dipsaci (Kühn 1858) Gerv. v Ben. 1859.

In the spring of 1934 a high percentage of infestation of Hart Nibbrig irises developed in an experimental plot of the Dominion Laboratory of Plant Pathology, Saanichton. This plot had previously been planted to narcissus and apparently the narcissus nematodes have transferred to the irises. Previously it was reported that under high light and slow growing conditions, the narcissus nematodes can be readily transferred to Barks' barley. (Hastings, R. J., J. E. Bosher, and W. Newton. The nematode disease of plants and crop sequence. Can. Jour. Res. 8:101. 1933) Under similar conditions the nematodes from iris have also been transferred to Barks' barley, and, therefore, the narcissus and iris nematodes are probably identical populations.

Anguillulina pratensis (de Man 1880) Goffart 1929, causing a root decline of narcissus and strawberry.

In 1932 a root decline of narcissus was observed in a field on South Vancouver Island, British Columbia. The fungus Cylindrocarpon radicicola Woll. was repeatedly isolated in association with a nematode, identified by Dr. G. Steiner as Anguillulina pratensis. According to Dr. Steiner this

nematode is probably the primary cause of the root decline and the fungus a secondary parasite. (Hastings, R. J., W. Newton, and G. Steiner. Root decline of narcissus. Pl. Dis. Reptr. 16:112-113, 1932)

The narcissus field was ploughed and planted to strawberries in the spring of 1934. The next autumn patches of unthrifty plants were evident in those areas where the narcissus root decline had occurred. Examination of the unthrifty plants revealed that the trouble was due to root rot. Anguillulina pratensis was frequently teased out from these roots. This strawberry infestation appears to be a case of transfer from narcissus to strawberry under field conditions.

In a nearby field another case of narcissus root decline caused by A. pratensis has been discovered. This infestation apparently was confined to zones approximately thirty feet in diameter and several such zones were observed in the planting. The conspicuous feature was the stunting of the bulbs within the zones.

Aphelenchoides fragariae (Ritzema Bos 1891) Christie 1932 on chrysanthemum and weeds.

Aphelenchoides fragariae was observed attacking outdoor chrysanthemums in South Vancouver Island, and appears to be a common pest in the field plots of chrysanthemums in this locality.

In one case observed on October 9, certain varieties were so severely blighted that they presented a badly scorched appearance. This condition was most noticeable in the varieties Buttercup, Rayonnante, and Almirante, in which infestation ranged from 30 to 80 per cent and the estimated pathogenicity from 40 to 50 per cent. Yellow Pearl was also rather severely affected but the amount of damage was lower, the pathogenicity being estimated at 20 per cent.

Weeds growing in the chrysanthemum plots were also infested. Senecio vulgaris L., common groundsel, and Trifolium repens L., white clover, showed brown water-soaked areas in the leaves which, when placed in water, yielded many A. fragariae. The nematode apparently transferred to these weeds even in the presence of the population host plant, the chrysanthemum.

Despite the fairly general infestation of outdoor chrysanthemums little loss was suffered by hot house plants, probably due to the removal of lower dead leaves and care in watering, and the possibility that the nicotine sulphate-soap solutions frequently used as a spray in chrysanthemum houses is nematicidal.

Attempts to transfer the chrysanthemum nematode to strawberries have yielded indefinite results. Strawberry plants grown from unrooted runners and inoculated with water suspensions have shown no evidence of dwarfing after three months growth during the winter in a greenhouse. However, no blooms have developed in the inoculated plants, while about 40 per cent

of the control plants are in bloom.

When infested chrysanthemum leaves are left in water overnight, the nematodes that are found in the suspension are frequently gathered into clusters some of which number several hundred individuals.

PEACH VIRUS DISEASES IN MICHIGAN IN 1934

The information contained in the accompanying table (Table 3) is abstracted from a mimeographed report issued by the Orchard and Nursery Inspection Service of the Michigan State Department of Agriculture. The report states that "This compilation includes a very small percentage of the entire peach tree plantings of the State. . ."

Table 3. Number of peach trees inspected in Michigan counties in 1934, and number infected with yellows, littles, and red suture (virus diseases).

County	Number peach trees inspected	Number of trees with Yellows	Littles	Red suture
Allegan	19,170	177	418	74
Antrim	67			
Branch	661	8		
Berrien	317,582	140	2,850	17
Ionia	87			
Jackson	731	5	1	
Kalamazoo	11,819	33	49	9
Kent	55,836	20	27	44
Leelanau	2,764			
Livingston	606			
Macomb	943			
Manistee	657			
Newaygo	2,222			
Oakland	6,270		1	
Oceana	14,518		42	
Ottawa	13,467	7	64	3
Van Buren	109,120	20	219	77
Washtenaw	12,038			
Total	568,558	410	3,671	224

DISEASES OF FOREST TREES

NECTRIA CANKER OF HARDWOODS: The Division of Forest Pathology makes a correction in the note published in the preceding issue of the Reporter (p.16). Under the Northeast region firecherry should be omitted from the hosts listed while red and black oak should be added.

STRUMELLA CANKER: This disease occurs in New Hampshire as well as in the other States listed on page 17 of the Reporter.